CLAIMS

What is claimed is:

1. A fuel cell assembly comprising:

at least one fuel cell comprising:

an anode and a cathode, each having an inlet and an exhaust;

an electrolyte interposed between the anode and the cathode;

a fuel passage in fluid communication with the anode for directing a fuel stream to and from the anode; and

an oxidant passage in fluid communication with the cathode for directing an oxidant stream to and from the cathode; and

a gas sensor operably associated with the fuel passage for measuring the concentration of hydrogen gas in the fuel stream, the sensor comprising a sound generator and a sound detector.

2. The fuel cell assembly of claim 1 wherein the sound generator is a transducer.

3. The fuel cell assembly of claim 2 wherein the sound generator is a piezoelectric transducer.

4. The fuel cell assembly of claim 1 wherein the sound detector is a transducer.

5. The fuel cell assembly of claim 4 wherein the sound detector is a piezoelectric transducer.

6. The fuel cell assembly of claim 4 wherein the sound generator is a transducer.

7. The fuel cell assembly of claim 1 wherein the gas sensor further comprises a temperature sensor.

8. The fuel cell assembly of claim 1 wherein the gas sensor is associated with the anode exhaust passage.

9. The fuel cell assembly of claim 1 further comprising a recirculating fuel line for directing the fuel stream from the anode exhaust back to the anode inlet.

10. The fuel cell assembly of claim 9 further comprising a purge valve for directing the fuel stream to either the recirculating fuel line or the external atmosphere.

11. The fuel cell assembly of claim 9 further comprising a liquid separator in the recirculating fuel line.

12. The fuel cell assembly of claim 9 further comprising a recirculation device in the recirculating fuel line.

13. A method of operating an electrochemical fuel cell system having an anode and a cathode, the method comprising:

directing an oxidant stream to and from the cathode;

directing a hydrogen stream to and from the anode;

determining the concentration of hydrogen in the hydrogen stream by: generating a sound in the fuel stream passage; measuring an acoustic property of the sound; and calculating the hydrogen concentration based on the measured acoustic property.

14. The method of claim 13 wherein the acoustic property is the speed of sound.

15. The method of claim 13 wherein the acoustic property is the frequency of sound.

16. The method of claim 13 wherein the acoustically determining step is in the anode exhaust.

17. The method of claim 16 wherein the electrochemical fuel cell system comprises a recirculating fuel line, the method further comprising purging the anode exhaust when the measured hydrogen concentration falls below a predetermined threshold.

18. A method of determining the concentration of hydrogen in a hydrogen gas line, the method comprising:

generating a sound in the hydrogen gas line;

measuring an acoustic property of the sound; and

calculating the hydrogen concentration based on the measured acoustic property.

19. The method of claim 18 wherein the acoustic property is the speed of sound.

20. The method of claim 18 wherein the acoustic property is the frequency of sound.

21. The method of claim 18 wherein the hydrogen gas line is in an electrochemical fuel cell.

22. The method of claim 21 wherein the hydrogen gas line is the anode exhaust of the electrochemical fuel cell.